Implementation of Biometric Attendance Management System on Cloud Environment

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Abstract

For any fast growing organization, tracking and monitoring employee time and attendance and preparing payroll are tedious, time consuming and risky as it is more prone to errors. Biometric time and attendance system is one of the most successful applications of biometric technology, serves an alternate for traditional manual signing process. The challenges in transforming towards biometric based attendance system from traditional system are, first, providing platform to store and maintain employee data, secondly the timely collection of huge amount of data from biometric machines, deployed as cluster of nodes, into a central database and finally to setting up a distributed computing environment to support the payroll process. We designed and implemented a reliable, scalable and cost effective Biometric Attendance payroll System over Cluster based Cloud technology, by which we successfully overwhelmed all these challenges. Our cloud based Biometric Attendance Manager (BAM) works with text files to collect data from different Biometric Terminals (BT) and process them to store in cloud based Enterprise Biometric Information Server (EBIS) to generate payroll.

***Keyword:** Biometric Attendance, Cloud Computing, BAM, EBIS and BT.*

1. INTRODUCTION

BT is the acronym of Biometric Terminal which is used to collect the finger templates of the employees and attendance information based on the same. It interacts with the Biometric terminals to fetch the IN and OUT timings of the employees and stores in a text file. BAM is the acronym of Biometric Attendance Manager that reads the IN and out timings of the employees from text file, processes and stores the Biometric attendance data in to the Database Servers like EBIS. The profile data of employee and their attendance are very crucial which are used in the payroll process. Also, implementing Biometric Attendance is complex and expensive investment is needed. This paper tries to solve the barriers to store the huge amount of attendance data and process them for payroll using cloud technology.

2. BACKGROUND

A. Challenges in implementing Biometric Attendance

First, we need the database of the employees including important parameters like employee ID, name and department. Then, we need to collect the finger templates of each employee and store them. We need a platform to store the above information. Then the attendance of the employees like IN and OUT time which may contain thousands of records for each day should be stored in a centralized repository. We also need a application to read and process the biometric attendance data to prepare the payroll.

B. Cloud Technology

Cloud computing is the delivery of computing as a service rather than a product, whereby shared resources, software, and information are provided to computers and other devices as a utility (like the electricity grid) over a network (typically the Internet). Cloud computing provides computation, software applications, data access, data management and storage resources without requiring cloud users to know the location and other details of the computing infrastructure [1]. It uses the internet and central remote servers to store and maintain data and applications. It also allows consumers and businesses to use applications without installation and access their personal files at any computer with internet access. It increases the efficiency of computing by centralizing storage, memory, processing and bandwidth. There are three fundamental models in Cloud computing. They are SaaS (Software as a Service), PasS (Platform as a Service) and IaaS (Infrastructure as a Service). A simple example of Cloud computing is Gmail and Yahoo as we do not need any separate software or hardware to use them.

3. SYSTEM DESIGN AND IMPLEMENTATION

In the following figure 1, we show the overview of the system. Each organization / institution has one or more Biometric Terminals (BT) to collect the finger templates and punching of IN and OUT. The number of BTs is flexible and based on the strength of the employees. This is the basic source to provide data. BAM is the Biometric Attendance Manager to read and process the data and store them. All organizations are connected with BAM under 100 Mbps network bandwidth. The EBIS is the enterprise system to hold the employee information and thousands of Biometric data.

BAM Middleware

The BAM Middleware is a system that handles the other functionalities like Leave Application Process and Data Replication Service related with BAM.

EBIS

The Enterprise Biometric Information Server is a high level database system that holds lakhs of biometric records. The data to this server is fetched from many BT (Biometric Terminals) of various locations.
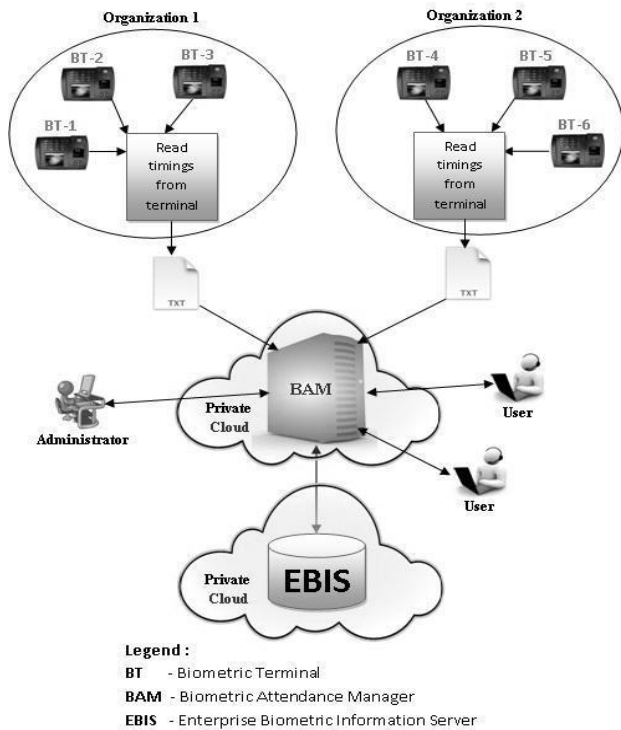
B. System Workflow

Figure – 1

The workflow of the system is shown using the figure - 3. At first, the system authenticates the users with a user friendly interface by getting user name and password. The user roles are also identified. Based on the roles, different access permissions are set on the users. Secondly, according to permissions the users can view their attendance; All Heads can view the attendance of the employees under them. The administrator can view all the records of all employees. Third, all the employees can apply for leave including CL (Casual Leave), EL (Earn Leave) and VL (Vacation Leave). Then the heads will approve the leave applications of the corresponding employees under them. It is shown in figure -4.

Figure – 3

The final approval is made by the attendance admin. In each stage, the employees can view the status of their leave applications in their login. All the employees can export the attendance information as excel file if required.

The attendance admin can finally generate the payroll by integrating the biometric attendance with leave applications. This is shown in figure-4.

Figure - 2

A. System Architecture

BAM Server

As shown in Figure – 2, the BAM is developed in Cloud environment. The data storage is built on enterprise Microsoft SQL servers. This can be described as PaaS (Platform as a Service).

We have extended the Saas (Software as a Service) based on PaaS. The BAM system is a web based and user friendly interface. The users can easily understand and interact with the BAM system to get their attendance on various forms.
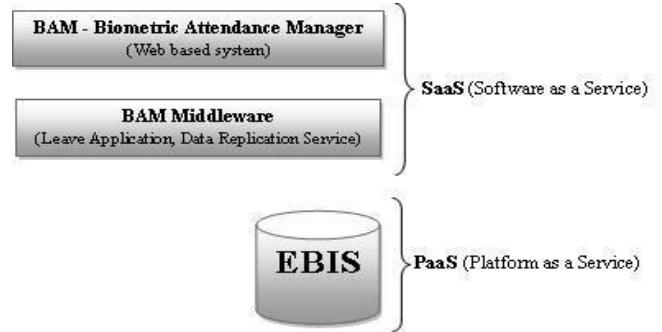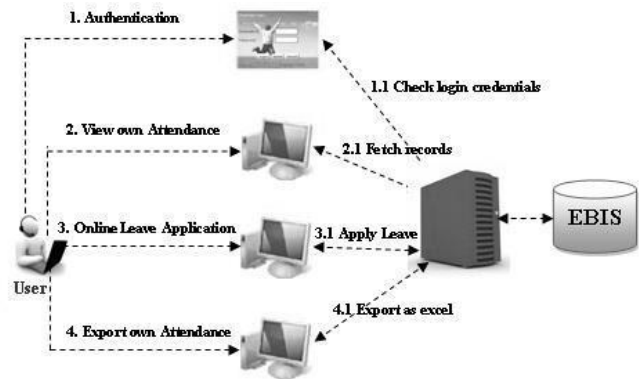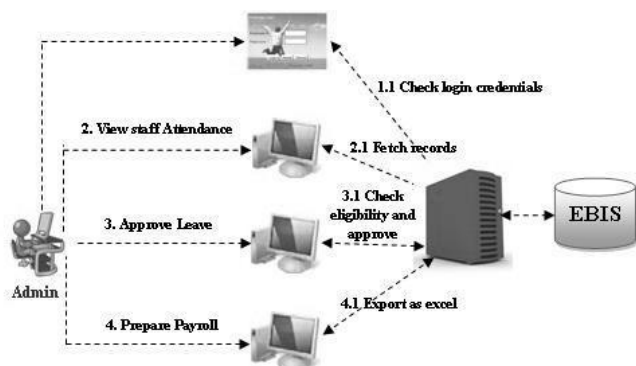
Figure – 4

4. COMPARISON WITH EXISTING SYSTEM

We have compared our system with existing one and found lot of advantages over that.

Experiment 1: Compare the cost effectiveness with the existing system. In this experiment, we compare the cost for organization with own servers and applications with organization under Cloud. It clearly shows that the organization under cloud spent less than the others since it is pay per use. Also there is no head ache over Hardware and Software maintenance as it is taken care by the Cloud provider themselves.

Cost Effectiveness comparison		
Resource	**Organization with own Resource setup**	**Organization under Cloud**
Server	400000	40000
Application	1200000	40000

The following graph clearly shows the graphical representation of the cost effectiveness.
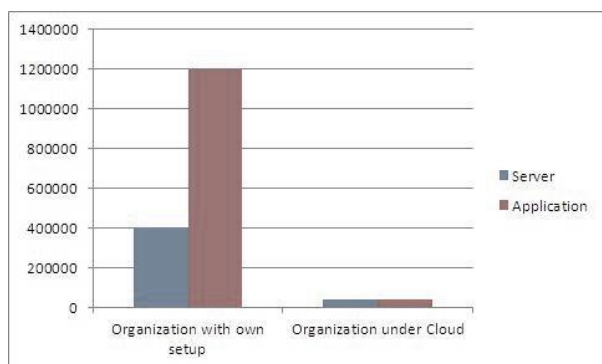

Figure – 5

Experiment 2: Then, we experiment our system with existing one in terms of process effectiveness in preparing payroll. With the current system, it is very complex to generate payroll every month since the integration of attendance data and leave applications is taking much time. Our BAM middleware system simplifies the process by integrating the both to quickly prepare the payroll. The accuracy of the data is also found improved.

Process effectiveness		
*	**Manual Attendance**	**Biometric Attendance**
Payroll process (days)	15	1
Data Accuracy	0.95	0.99

The corresponding graph in figure-6 for the above table shows it clearly that the payroll processing time is decreased and data accuracy is also improved.
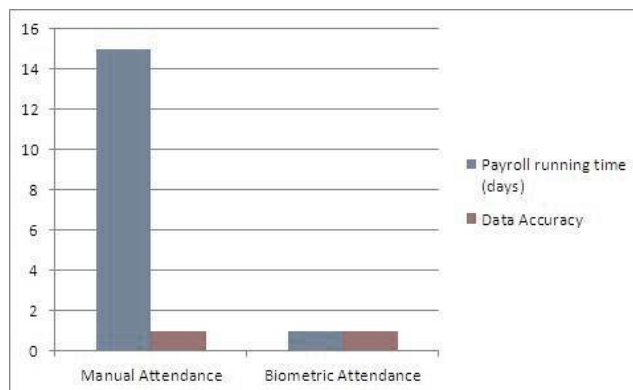

Figure - 6

5. CONCLUSION

From our experience, we conclude that the BAM is a flexible, scalable, cost effective, efficientand easily manageable system.

Scalability: We can add as many numbers of BT and users we want without doing much modification in the system.
Cost Effective: The cost effectiveness is another important factor in our system. We need not spent for dedicated servers for application and database as everything managed by the Cloud providers.
Efficient: All the users can view the attendance and the status of their leave applications. We can generate the monthly payroll in ease.

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